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STATUS OF ATLANTIC SALMON IN THE TABUSINTAC RIVER IN 1993

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[1]La présente série documente les bases scientifiques des évaluations des ressources halieutiques sur la côte Atlantique du Canada. Elle traite des problèmes courants selon les échéanciers dictés. Les documents qu'elle contient ne doivent pas être considérés comme des énoncés définitifs sur les sujets traités, mais plutôt comme des rapports d'étape sur les études en cours.

Les documents de recherche sont publiés dans la langue officielle utilisée dans le manuscrit envoyé au secrétariat.

SUMMARY SHEET

STOCK: Tabusintac River, SFA 16
TARGET: 1.9 million eggs (372 large salmon, 200 small salmon)
REARING AREA: 778,000 m^2, 1% of SFA 15, <1% of Gulf New Brunswick

	1988	1989	1990	1991	1992	1993	MIN	MAX	MEAN
Angling									
Large (Released)	359	165	80	84	488	n/a	25	488	235
Small (Rel + Kept)	180	184	95	154	330	n/a	19	261	189
First Nation Harvest									
Large					270	101			
Small					126	79			
Spawning escapement									
Large						667			
Small						348			
Total returns									
Large						799			
Small						599			
% egg target met									
						184			

Landings: Final estimates of angling catches for 1993 were not available at time of publication. First Nation catches were 35% to 65% lower in 1993 than 1992.

Data and assessment: A mark-recapture experiment was the basis for estimating population size and spawning escapement on the Tabusintac River. Tag recoveries from angling fisheries were used as the recapture sites. Angling catches in the kelt fishery as reported and the bright fishery after adjusting for exploitation rate were used as indices of spawning escapement in past years.

State of the stock: Spawning targets for small and large salmon were met in 1993 and in most years since 1984.

Forecast: No forecast is available for 1994.

ABSTRACT

Small salmon angling catch as estimated by New Brunswick Department of Natural Resources were preliminary at time of publication and large salmon releases are not estimated by Department of Fisheries and Oceans. As a result, preliminary comparisons of angling catch in 1993 with other years is made using DFO small salmon catches and catches in leased waters. These estimates indicate that small salmon kelt catches were 31% less in 1993 than 1992 and that small bright salmon catches were 17% less in 1993 compared to 1992. In contrast angling in leased water was 10% above 1992 for small salmon and 31% above for large salmon. First Nation catches were 37% less than 1992 for small salmon and 63% less than 1992 for large salmon. Small salmon total returns in 1993 were 559 with a spawning escapement of 348 which was above spawning target escapement. Large salmon total returns in 1993 were 799 with a spawning escapement of 667 which was above the spawning target. Spawning indices based on the kelt and bright angling fisheries indicate that spawning requirements were met in most years on the Tabusintac River.

RESUME

Les estimations de prises de petit saumon par les pêcheurs à la ligne établies par le ministère des Ressources naturelles du Nouveau-Brunswick étaient préliminaires au moment de la publication du présent document. Comme, en outre, le ministère des Pêches et des Océans n'établit pas d'estimations des remises à l'eau de grand saumon, on a donc procédé à des comparaisons préliminaires des prises de la pêche sportive en 1993 et dans les années antérieures en se fondant sur les statistiques de prises de petit saumon émanant du MPO et sur les prises dans les cantonnements de pêche loués. Il en ressort qu'en 1993, les prises de petit saumon noir et celles de petit saumon de montée étaient respectivement inférieures de 31 % et de 17 % aux résultats de 1992. En revanche, les prises des pêcheurs à la ligne dans les cantonnements de pêche loués étaient supérieures de 10 % dans le cas du petit saumon et de 31 % dans le cas du grand saumon à celles de 1992. En 1993 également, les prises des premières nations étaient en recul par rapport à celles de 1992, de 37% pour ce qui est du petit saumon et de 63 % pour ce qui est du gros saumon. Les remontées totales de petit saumon se chiffraient à 559 et l'échappée de géniteurs à 348, ce qui était supérieur à la cible. Les remontées totales de gros saumon étaient de 799; l'échappée de géniteurs, qui atteignait 667, dépassait elle aussi la cible. D'après les indices de frai fondés sur la pêche à la ligne du saumon noir et du saumon de montée, les besoins en géniteurs ont été comblés presque tous les ans dans la Tabusintac.

INTRODUCTION

The purpose of this document is to provide an assessment of the Atlantic salmon stock in the Tabusintac River in 1993.

The Tabusintac River is situated in Northumberland County, New Brunswick and flows east into the Gulf of St. Lawrence (Statistical District 70, Salmon Fishing Area 16, Figs.1, 2). Although a few salmon may enter the river in June and July, the main run is believed to occur during September and October.

Kelts are angled from April 15 to May 15; brights from July 1 to October 21. Prior to 1984 kelts and bright fish 63 cm or over (large salmon) could be kept. In 1984 large salmon kelts could be kept but all large bright salmon had to be released. Since 1984, regulations have required all large salmon to be released, and only fish less than 63 cm (small salmon) could be retained. In 1992, the season limit for small salmon was reduced from ten to eight. This regulation remained in effect in 1993. Burnt Church First Nation harvests salmon by gillnet and trapnet during the fall run. There has been no commercial harvest in Salmon Fishing Area 16 from 1984 to 1993.

MATERIALS AND METHODS

Landings

Recreational catch estimates are obtained from two sources. Department of Fisheries and Oceans (DFO) statistics are harvest estimates made by fishery officers from observations of average number of rods/day and average catch, during routine patrols on public water, plus numbers of kept fish reported in leased water; no estimate of released fish is provided. The New Brunswick Department of Natural Resources and Energy (DNRE) estimates catch (harvested and released) based on a random survey of approximately 15 percent of license purchasers. A component of the DNRE estimate, the catch statistics provided by the Tabusintac Club as a condition of their lease on the river, are available separately. The DNRE figures are considered the best estimate of angling catch, but 1993 estimates are preliminary and probably underestimate catch. As a result, total angling removals for 1993 were estimated using Tabusintac Club and DFO statistics. A 3% hook and release mortality was assumed to apply to all releases as for the Miramichi River (Currie 1985). Large salmon removals were calculated in a two step process. First, large salmon releases in public waters were estimated, and second, total large salmon hook and release mortality was estimated.

Small salmon removals = DFO kept + 0.03 x small salmon Club releases.

Large salmon public releases = (Large salmon Club releases / Small salmon Club catch) x Small salmon public catch

Large salmon removals = 0.03 x (Club + public large salmon releases)

First Nation harvest from the Tabusintac river was not recorded prior to 1992. Beginning in 1992, Burnt Church First Nation has provided harvest statistics to DFO Resource Allocation.

Commercial landings for Salmon Fishing Area 16 (1967-1983) are reported; the fishery was closed in 1984.

Spawning Requirements

The required number of spawners for the Tabusintac was calculated using the method (Method 2) recommended by Randall (1985) for the Miramichi River, as described below. The number of spawners required to meet egg deposition requirements was calculated presuming that all egg deposition came from large salmon. The numbers of small salmon required were calculated assuming that at least one male spawner was needed for each female large salmon.

Spawning requirements were determined using the method outlined below. Fecundity was assumed to be equivalent to Miramichi stock, based on similar mean length and river proximity. Sex ratios were determined by external examination at the trapnet.

Egg deposition rate = 2.4 eggs/square meter (Elson 1975)

Rearing area = 778,000 square meters (Anon 1978)

Mean length = Large salmon- 79cm; Small salmon- 56cm

Fecundity = Large salmon- 6816 eggs; Small salmon- 2908 eggs (Randall 1985)

Sex ratio = Large salmon- 75% female; 25% male

= Small salmon- 7% female; 93% male

Eggs/large salmon = 6816 x 0.75 = 5112

Eggs/small salmon = 2908 x 0.07 = 204

Eggs required = 2.4 eggs/sq m x 778,000 sq m

= 1.9 million eggs

Large salmon required = 1,900,000 / 5112 = 372

Large salmon females = 372 x 0.75 = 279

Large salmon males = 372 - 279 = 93

Small salmon males required to balance sex ratio = 279 - 93

= 186

Small salmon required (total) = 186 / 0.93 = 200

Total Returns, Spawning Escapement, and Egg Deposition

In 1993, in cooperation with Burnt Church First Nation, two trapnets were operated in the tidal portion of the river to mark and recapture salmon. The lower (mark trap) was situated one half km upstream (west) of the Route 460 bridge at Cairns Point, the upper (recapture trap) approximately two km beyond this, both adjacent to Reserve land. The box portion of the traps measured 12 feet wide by 60 feet long and was constructed with 2.25 inch mesh knotless nylon. Downstream-angled leaders of approximately 100 and 200 feet, one extending to shore, were made from 5.5 inch mesh polypropylene. All salmon caught in the traps were marked with small blue Carlin tags attached with a single wire through the back immediately in front of the dorsal fin.

Tags were recaptured from the upper trap, the native gillnet fishery, and anglers both on the Crown Lease and public water. All gillnet and angling recaptures occurred upstream of the trapping sites. Sampled catch size for these recapture methods were obtained from trap logbooks, First Nation catch reports, catch records on lease water provided by the Tabusintac Club, and telephone calls to anglers on public water who returned tags, for information on their total catch.

An estimate of the total returns to the river was obtained using a Bayesian estimator as described by Gazey and Staley (1986). The most probable population size given R recaptures out of M marks placed in a sampled catch of C was calculated over a range of possible population sizes.

Spawning escapement was then calculated as follows:

Spawners = Total returns - Removals (First Nation, angling, poaching)

Egg deposition was calculated as the number of small or large salmon spawners times the eggs per small or large salmon, as calculated above.

Biological Characteristics

Fork length of all fish trapped was measured, and scale samples were taken for ageing. Sex was determined on external features. Fecundity has been assumed based on mean size similarity to Miramichi stock (Randall 1985). In future, sampling of First Nation catch is expected to provide verification of sex ratio, fecundity and length/weight relationship.

Forecast

The relationship between small salmon angling catch in one year and large salmon angling catch the following year was examined to determine if it could be used to provide a pre-season forecast for the Tabusintac River.

Other species

Brook trout, gaspereau, suckers, striped bass, flounder, eels, tomcod, white perch and smelt were caught and enumerated at the trapnets.

RESULTS AND DISCUSSION

Landings

Commercial landings for Salmon Fishing Area 16 (1967-1983) are presented in Table 1; since this fishery was closed in 1984 it no longer affects returns of spawning fish. Because this is the first assessment of the Tabusintac River, the table is included as an historical document. DFO angling catch statistics (1951-1993) are shown in Table 2, the DNRE angling catch (1969-1993) in Table 3, and the Tabusintac Club angling catch (1981-1993) in Table 4. Since 1984, all large salmon angling has been catch and release;

and the Tabusintac Club angling catch (1981-1993) in Table 4. Since 1984, all large salmon angling has been catch and release; additionally, anglers have released increasing numbers of small salmon. DFO and DNRE estimates prior to 1984 are assumed to represent kept fish; most large salmon caught by the Tabusintac Club prior to 1984 were released. Dashes (-) in the above tables indicate that values could not be calculated (eg. from insufficient survey returns), or are not presently available.

The 1993 DFO estimate for kept small salmon kelts declined 31% (Table 2), and the DNRE estimate by 22% (Table 3) from the previous five year mean. The DFO estimate for kept small bright salmon is down 17%, and DNRE is also down by 46%. In the early bright season small salmon harvest was down 57% (DFO). Late bright harvest declined 14% (DFO) and 54% (DNRE).

The DNRE estimate of total (kept + released) small salmon kelt catch was down 16%. Total (kept + released) small salmon bright catch was down 23% (Table 3).

DNRE estimates show a 6% decline in large salmon kelt catch (released) and a decline of 77% in total bright large salmon catch (released). Early bright large salmon catch was down 81% and late bright by 77% (Table 3).

The Tabusintac Club statistics show a 10% increase in total (early + late) bright catch of small salmon, and an increase of 21% for large salmon , over the previous five year mean (Table 4). Kelts are not angled in lease water, and most small salmon are released.

First Nation harvest from the Tabusintac River in 1992 was 270 large and 126 small salmon. In 1993 37 large and 31 small salmon were harvested from trapnets, 64 large and 48 small salmon from gillnets, for a total of 101 large and 79 small salmon. This represents a reduction of 63% for large salmon and 37% for small salmon. Burnt Church First Nation agreed to a maximum harvest of 200 large and 380 small salmon from the Tabusintac River in 1993, as a condition of the Aboriginal Fisheries Strategy agreement with DFO.

Total Returns and Spawning Escapement

The lower trap was operated from August 6 to October 28, and the upper from July 31 to October 28; the first salmon was caught on August 31. Daily catches of salmon and grilse at both traps are presented in Figure 3, and a summary by standard week in Table 5. Table 6 describes the standard weeks.

Tagging effort and recaptures may be summarized as follows:

Tags Applied

Location	Large	Small
Marking trap	111	90
Recapture trap	32	35
Total	143	125

Tag Recaptures

	Large		Small	
Location	Recap	Catch	Recap	Catch
Recapture trap	1	40	2	40
Public angling	3	12	4	12
Club (lease) angling	12	76	15	76
First Nation gillnets	5	64	3	48

Due to low returns from the recapture trap and the uncertainty of tag reporting rate in the First Nation fishery, the angling returns were considered most reliable and were pooled for use in the Bayesian method of population estimation. Although the angler sample from the public water may be slightly biased since only those returning tags were called, this was only 21% of total tags returned; returns from lease water (79%) represented all angling on that section.

Estimated removals from the population were as follows:

Location	Large	Small
First Nation Food	101	79
Angling	6	131
Poaching	25	0

First Nation food fish are totals of reported catch from gillnets plus food fish removed from traps; angling removals are combined kept plus hook and release mortalities as described above. Poaching removals have been estimated by DFO fishery officers for

public waters. The Tabusintac is well protected by Club wardens and fishery officers and poaching is felt to be minimal in this area.

Weekly (Table 5) and daily (Fig. 3) counts at the trapnets indicate that peaks in run-timing to the river occurred from September 24 to October 7 for both grilse and salmon.

Total returns were estimated using the data provided above and using the adjusted Petersen method (Ricker 1975) and the Bayesian method of Gazey and Staley (1986). Only tags returned from angling catches were used in the estimate. These tags were assumed to have a reporting rate of 100%. The reason for this assumption was that all angling in club waters is carefully monitored and reported by guides. Anglers returning tags from public water angling catch were telephoned to obtain information on their total catch. A tag loss rate of 0.9% per day as determined for the Margaree River (Chaput et al. 1993) was applied to the mean number of days a fish was at large (10.3) before recapture, thus reducing the number of tags available.

The distribution for estimates of total returns to the river indicate that the most probable is 559 for small salmon and 799 for large salmon (Figs. 4,5). Subtracting removals as above indicated that spawning escapement for small salmon was 349 and for large salmon was 667 (Figs. 4,5). The probability of exceeding target spawning escapement for small and large salmon was greater than 95% in 1993 (Figs. 6,7).

An index of spawning can be obtained from kelt angling catches the following spring. If the assumptions are made that all kelts survive the winter and are caught in the spring fishery and that there are no multiple hook and releases, then years when spawning requirements exceeded the target can be identified directly from kelt catches. The y-axis in Fig. 8 indicates that for small salmon spawning requirements have been exceeded in three years, 86, 87, and 91 based on kelt catches. For large salmon this has occurred in two years, 86, and 91.

An additional index of spawning escapement may be obtained by converting recent angling catches to spawning escapement using the following formula:

Spawning escapement = (Angling/Exploitation rate) - Angling

In 1993, the exploitation rate was 30%. If this rate is used then number of spawners based on angling catch indicates that spawning requirements for small salmon have been exceeded in all years since 1984 except one. Using this method indicates that spawning escapement for large salmon has been exceeded in all but three

years since 1984 (Fig. 8).

These results indicate that spawning requirements have usually been met in recent years on the Tabusintac River.

Biological Characteristics

The length frequency distribution of salmon trapped in 1993 is presented in Figure 9. Modal length of small salmon was 56 cm and of large salmon 74 cm. The age distribution of the sample from 1992 is shown in Table 7. Of known-age fish, 2+ and 3+ smolts each comprised 50% of the sample. Repeat spawners accounted for 14% of large salmon . The mean length of large salmon was 79cm; 75% were females and 25% males. Mean length of small salmon was 56cm; 7% were females and 93% males. The large salmon proportion of the catch in 1993 was 53%, small salmon making up 47%.

Forecast

There was no relationship between small salmon angling catch and large salmon angling catch the following year (Fig. 10). As a result, a forecast for 1994 is not possible. It may be possible to develop in-season forecasting using run-timing to the trapnet when a sufficient number of years of trapnet operation have accumulated.

Other species

Total counts of other species caught in the traps are as follows:

Species	Count
Brook Trout	128
Gaspereau	1682
Suckers	404
Striped Bass	348
Flounder	69
Eels	75
Tomcod	60
White Perch	3
Smelt	1

Literature Cited

Anonymous, 1978. Biological conservation subcommittee report. Prepared for the Atlantic Salmon Review Task Force.

Chaput, G., R. Jones, L. Forsyth, and P. LeBlanc. 1993. Assessment of Atlantic salmon in the Margaree River, Nova Scotia, 1992. DFO Atlantic Fisheries Research Document 93/14.

Currie, B. 1985. North Pole Stream hook and release program. Proceedings of the 1985 Northeast Salmon Workshop, Moncton, NB.

Elson, P.F. 1975. Atlantic salmon rivers. Smolt production and optimal spawning - an overview of natural production. Int. Atlantic Sal. Found. Spec. Public. Ser. 6:96-119.

Gazey, W.J., and M.J. Staley. 1986. Population estimation from mark-recapture experiments using a sequential Bayes algorithm. Ecology 67: 941-951.

Randall, R.G. 1985. Spawning potential and spawning requirements of Atlantic salmon in the Miramichi River, New Brunswick. CAFSAC Res. Doc. 85/68.

Ricker, W.E. 1975. Computation and interpretation of biological statistics of fish populations. Bull. Fish. Res. Board Can. No. 191. 382p.

Table 1. Commercial salmon landings for Salmon Fishing Area 16 (1967-1983) in kg.
The commercial fishery was closed in SFA 16 from 1984 on. The Tabusintac R. is in District 70.

	Fisheries Statistical District									
Year	70	71	72	73	75	76	77	78	80	Total
1967	37,621	21,913	10,314	324,802	31,670	23,805	56	8	0	450,188
1968	18,233	19,790	6,435	150,614	13,916	8,505	29	0	0	217,523
1969	12,388	20,674	12,195	116,097	14,464	7,051	5	61	0	182,935
1970	12,763	20,307	12,460	104,595	13,443	11,618	6	12	0	175,205
1971	5,741	12,628	7,928	51,343	1,635	1,899	4	2	0	81,180
1972	0	5	682	10,034	0	227	227	1,555	91	12,820
1973	114	136	45	2,732	545	364	150	0	114	4,200
1974	159	152	0	3,318	136	0	[illegible]	16	84	3,925
1975	108	117	0	2,503	556	1,775	69	325	227	5,680
1976	138	129	45	6,464	315	591	105	909	1,023	9,718
1977	0	153	0	27,645	1,927	685	227	1,364	136	32,137
1978	2,112	11	0	36,561	655	674	656	445	0	41,114
1979	2,486	9	0	16,053	886	342	84	230	0	20,090
1980	26,586	0	0	29,607	1,134	606	0	0	0	57,933
1981	3,534	10,463	2,029	20,179	1,502	483	0	0	0	38,190
1982	3,454	8,581	652	28,699	2,819	1,127	0	34	0	45,366
1983	4,498	5,735	763	33,069	1,540	847	0	0	0	46,452

Table 2. Atlantic salmon angling catch on the Tabusintac River, 1951-1993. Estimates provided by DFO fishery officers. Large salmon kelts could be retained in 1984, after which all large salmon angling was catch-and-release: releases not shown. Distinctions between large and small salmon were not always made by field staff.

	Kelts						Total Bright Salmon					
Year	Small	Large	Total	% Large	Rods	CPUE	Year	Small	Large	Total	% Large	Rods	CPUE
1951	0	832	832	100.0	616	1.351	1951	-	-	-	-	-	-
1952	0	3065	3065	100.0	915	3.350	1952	0	2198	2198	100.0	876	2.509
1953	0	3186	3186	100.0	2457	1.297	1953	0	3200	3200	100.0	1130	2.832
1954	0	864	864	100.0	878	0.984	1954	0	3256	3256	100.0	1156	2.817
1955	0	994	994	100.0	1026	0.969	1955	0	500	500	100.0	831	0.602
1956	0	243	243	100.0	840	0.289	1956	0	401	401	100.0	1303	0.308
1957	0	261	261	100.0	858	0.304	1957	0	257	257	100.0	1116	0.230
1958	0	200	200	100.0	1060	0.189	1958	0	376	376	100.0	3736	0.101
1959	0	202	202	100.0	910	0.222	1959	0	403	403	100.0	935	0.431
1960	0	276	276	100.0	930	0.297	1960	0	441	441	100.0	800	0.551
1961	0	212	212	100.0	480	0.442	1961	0	540	540	100.0	780	0.692
1962	0	390	390	100.0	630	0.619	1962	0	430	430	100.0	580	0.741
1963	0	490	490	100.0	584	0.839	1963	2	773	775	99.7	505	1.535
1964	0	685	685	100.0	810	0.846	1964	0	1288	1288	100.0	725	1.777
1965	445	195	640	30.5	630	1.016	1965	912	1282	2194	58.4	976	2.248
1966	0	609	609	100.0	630	0.967	1966	1530	960	2490	38.6	1140	2.184
1967	0	720	720	100.0	750	0.960	1967	283	125	408	30.6	1055	0.387
1968	0	768	768	100.0	882	0.871	1968	52	224	276	81.2	1049	0.263
1969	0	398	398	100.0	720	0.553	1969	255	201	456	44.1	947	0.482
1970	201	152	353	43.1	410	0.861	1970	256	107	363	29.5	630	0.576
1971	262	173	435	39.8	410	1.061	1971	79	148	227	65.2	475	0.478
1972	50	15	65	23.1	120	0.542	1972	109	256	365	70.1	625	0.584
1973	64	274	338	81.1	360	0.939	1973	47	173	220	78.6	555	0.396
1974	65	240	305	78.7	350	0.871	1974	100	217	317	68.5	830	0.382
1975	42	105	147	71.4	180	0.817	1975	96	270	366	73.8	755	0.485
1976	25	60	85	70.6	175	0.486	1976	197	330	527	62.6	655	0.805
1977	40	135	175	77.1	320	0.547	1977	72	65	137	47.4	245	0.559
1978	65	165	230	71.7	510	0.451	1978	11	37	48	77.1	195	0.246
1979	18	29	47	61.7	350	0.134	1979	41	19	60	31.7	500	0.120
1980	25	75	100	75.0	185	0.541	1980	110	144	254	56.7	460	0.552
1981	25	192	217	88.5	320	0.678	1981	126	81	207	39.1	838	0.247
1982	145	170	315	54.0	382	0.825	1982	205	98	303	32.3	678	0.447
1983	253	342	595	57.5	774	0.769	1983	59	33	92	35.9	554	0.166
1984	6	86	92	93.5	720	0.128	1984	55	0	55	0.0	527	0.104
1985	55	0	55	0.0	542	0.101	1985	107	0	107	0.0	591	0.181
1986	73	0	73	0.0	568	0.129	1986	148	0	148	0.0	853	0.174
1987	44	0	44	0.0	310	0.142	1987	112	0	112	0.0	635	0.176
1988	173	0	173	0.0	771	0.224	1988	181	0	181	0.0	739	0.245
1989	562	0	562	0.0	1187	0.473	1989	138	0	138	0.0	651	0.212
1990	142	0	142	0.0	620	0.229	1990	172	0	172	0.0	898	0.192
1991	230	0	230	0.0	650	0.354	1991	114	0	114	0.0	505	0.226
1992	155	0	155	0.0	350	0.443	1992	169	0	169	0.0	590	0.286
1993	175	0	175	0.0	450	0.389	1993	129	0	129	0.0	520	0.248
Mean(88-92)	252	0	252	0.0	716	0.353	Mean(88-92)	155	0	155	0.0	677	0.229
+/- Mean	-31%	-	-31%	-	-37%	10%	+/- Mean	-17%	-	-17%	-	-23%	8%

(Continued)

Table 2. (Continued)

	Early Bright Salmon					
Year	Small	Large	Total	% Large	Rods	CPUE
1951	-	-	-	-	-	-
1952	-	-	-	-	-	-
1953	0	207	207	100.0	138	1.500
1954	0	2	2	100.0	18	0.111
1955	-	-	-	-	-	-
1956	-	-	-	-	-	-
1957	0	8	8	100.0	30	0.267
1958	0	27	27	100.0	192	0.141
1959	0	18	18	100.0	170	0.106
1960	0	1	1	100.0	30	0.033
1961	-	-	-	-	-	-
1962	0	40	40	100.0	50	0.800
1963	2	18	20	90.0	35	0.571
1964	0	53	53	100.0	85	0.624
1965	0	44	44	100.0	70	0.629
1966	25	15	40	37.5	90	0.444
1967	7	12	19	63.2	95	0.200
1968	9	41	50	82.0	89	0.562
1969	30	46	76	60.5	112	0.679
1970	60	22	82	26.8	90	0.911
1971	14	18	32	56.3	70	0.457
1972	44	51	95	53.7	135	0.704
1973	10	18	28	64.3	85	0.329
1974	33	27	60	45.0	350	0.171
1975	16	35	51	68.6	179	0.285
1976	57	100	157	63.7	225	0.698
1977	24	28	52	53.8	85	0.612
1978	4	5	9	55.6	70	0.129
1979	3	8	11	72.7	150	0.073
1980	25	34	59	57.6	170	0.347
1981	79	8	87	9.2	190	0.458
1982	60	0	60	0.0	350	0.171
1983	4	5	9	55.6	126	0.071
1984	21	0	21	0.0	213	0.099
1985	20	0	20	0.0	201	0.100
1986	38	0	38	0.0	296	0.128
1987	17	0	17	0.0	147	0.116
1988	7	0	7	0.0	57	0.123
1989	16	0	16	0.0	100	0.160
1990	12	0	12	0.0	180	0.067
1991	2	0	2	0.0	80	0.025
1992	10	0	10	0.0	140	0.071
1993	4	0	4	0.0	125	0.032
Mean(88-92)	9	0	9	0.0	111	0.084
+/- Mean	-57%	-	-57%	-	12%	-62%

	Late Bright Salmon					
Year	Small	Large	Total	% Large	Rods	CPUE
1951	-	-	-	-	-	-
1952	0	2198	2198	100.0	876	2.509
1953	0	2993	2993	100.0	992	3.017
1954	0	3254	3254	100.0	1138	2.859
1955	0	500	500	100.0	831	0.602
1956	0	401	401	100.0	1303	0.308
1957	0	249	249	100.0	1086	0.229
1958	0	349	349	100.0	3544	0.098
1959	0	385	385	100.0	765	0.503
1960	0	440	440	100.0	770	0.571
1961	0	540	540	100.0	780	0.692
1962	0	390	390	100.0	530	0.736
1963	0	755	755	100.0	470	1.606
1964	0	1235	1235	100.0	640	1.930
1965	912	1238	2150	57.6	906	2.373
1966	1505	945	2450	38.6	1050	2.333
1967	276	113	389	29.0	960	0.405
1968	43	183	226	81.0	960	0.235
1969	225	155	380	40.8	835	0.455
1970	196	85	281	30.2	540	0.520
1971	65	130	195	66.7	405	0.481
1972	65	205	270	75.9	490	0.551
1973	37	155	192	80.7	470	0.409
1974	67	190	257	73.9	480	0.535
1975	80	235	315	74.6	576	0.547
1976	140	230	370	62.2	430	0.860
1977	48	37	85	43.5	160	0.531
1978	7	32	39	82.1	125	0.312
1979	38	11	49	22.4	350	0.140
1980	85	110	195	56.4	290	0.672
1981	47	73	120	60.8	648	0.185
1982	145	98	243	40.3	328	0.741
1983	55	28	83	33.7	428	0.194
1984	34	0	34	0.0	314	0.108
1985	87	0	87	0.0	390	0.223
1986	110	0	110	0.0	557	0.197
1987	95	0	95	0.0	488	0.195
1988	174	0	174	0.0	682	0.255
1989	122	0	122	0.0	551	0.221
1990	160	0	160	0.0	718	0.223
1991	112	0	112	0.0	425	0.264
1992	159	0	159	0.0	450	0.353
1993	125	0	125	0.0	395	0.316
Mean(88-92)	145	0	145	0.0	565	0.257
+/- Mean	-14%	-	-14%	-	-30%	23%

Table 3. Atlantic salmon angling catch on the Tabusintac River, 1969-1993. Estimates provided by DNRE. Large salmon kelts could be retained in 1964, after which all large salmon angling was catch-and-release. Dashes (-) indicate insufficient data to calculate; 1993 values are preliminary.

	Kelts							
	Small							
Year	Kept	Rel	Total	Large	TOTAL	% Large	Rods	CPUE
1969	150	-	150	49	199	24.6	-	-
1970	111	-	111	97	208	46.6	-	-
1971	114	-	114	57	171	33.3	-	-
1972	29	-	29	26	55	47.3	-	-
1973	20	-	20	154	174	88.5	-	-
1974	34	-	34	113	147	76.9	-	-
1975	49	-	49	90	139	64.7	-	-
1976	36	-	36	7	43	16.3	314	0.137
1977	-	-	-	52	52	100.0	-	-
1978	53	-	53	89	142	62.7	320	0.444
1979	7	-	7	-	7	-	190	0.037
1980	38	-	38	15	53	28.3	69	0.768
1981	74	-	74	89	163	54.6	133	1.226
1982	531	-	531	135	666	20.3	684	0.974
1983	160	-	160	60	220	27.3	640	0.344
1984	331	106	437	234	671	34.9	-	-
1985	-	-	-	38	38	100.0	77	0.494
1986	51	-	51	60	111	54.1	-	-
1987	62	196	258	545	803	67.9	304	2.641
1988	132	139	271	187	458	40.8	140	3.271
1989	96	17	113	140	253	55.3	116	2.181
1990	112	-	112	269	381	70.6	1059	0.360
1991	109	36	145	87	232	37.5	494	0.470
1992	125	98	223	467	690	67.7	686	1.006
1993	89	57	146	216	362	59.7	-	-
Mean(88-92)	115	-	173	230	403	54.4	499	1.458
+/- Mean	-22%	-	-16%	-6%	-10%	10%	-	-

	Total Bright Salmon							
	Small							
Year	Kept	Rel	Total	Large	TOTAL	% Large	Rods	CPUE
1969	126	-	126	133	259	51.4	-	-
1970	46	-	46	25	71	35.2	-	-
1971	24	-	24	31	55	56.4	-	-
1972	67	-	67	244	311	78.5	-	-
1973	107	-	107	114	221	51.6	-	-
1974	28	-	28	68	96	70.8	-	-
1975	115	-	115	49	164	29.9	-	-
1976	228	-	228	43	271	15.9	773	0.351
1977	-	-	-	-	-	-	84	-
1978	101	-	101	66	167	39.5	1634	0.102
1979	15	-	15	-	15	-	366	0.041
1980	115	-	115	69	184	37.5	804	0.229
1981	166	-	166	14	180	7.8	627	0.287
1982	261	-	261	153	414	37.0	1359	0.305
1983	90	-	90	140	230	60.9	1540	0.149
1984	123	-	123	68	191	35.6	1118	0.171
1985	19	-	19	38	57	66.7	229	0.249
1986	129	-	129	301	430	70.0	1147	0.375
1987	116	-	116	258	374	69.0	598	0.625
1988	77	103	180	359	539	66.6	437	1.233
1989	122	62	184	165	349	47.3	531	0.657
1990	64	31	95	80	175	45.7	740	0.236
1991	70	84	154	84	238	35.3	847	0.281
1992	227	103	330	488	818	59.7	1663	0.492
1993	61	85	146	53	199	26.6	-	-
Mean(88-92)	112	77	189	235	424	55.5	844	0.580
+/- Mean	-46%	11%	-23%	-77%	-53%	-52%	-	-

(Continued)

Table 3. (Continued)

Early Bright Salmon

Year	Small Kept	Small Rel.	Small Total	Large	TOTAL	% Large	Rods	CPUE
1969	38	-	38	37	75	49.3	-	-
1970	7	-	7	-	7	-	-	-
1971	-	-	-	-	-	-	-	-
1972	18	-	18	12	30	40.0	-	-
1973	-	-	-	7	7	100.0	-	-
1974	-	-	-	23	23	100.0	-	-
1975	-	-	-	-	-	-	-	-
1976	150	-	150	14	164	8.5	-	-
1977	-	-	-	-	-	-	-	-
1978	-	-	-	24	24	100.0	-	-
1979	-	-	-	-	-	-	-	-
1980	-	-	-	-	-	-	-	-
1981	92	-	92	7	99	7.1	-	-
1982	144	-	144	90	234	38.5	-	-
1983	50	-	50	50	100	50.0	-	-
1984	13	-	-	13	-	-	-	-
1985	-	-	-	-	-	-	-	-
1986	60	-	-	241	-	-	-	-
1987	-	-	-	17	-	-	-	-
1988	7	-	-	78	-	-	-	-
1989	-	-	-	52	-	-	-	-
1990	24	-	-	24	-	-	-	-
1991	14	-	-	14	-	-	266	0.105
1992	36	36	-	63	135	46.7	724	0.186
1993	17	-	17	9	26	34.6	-	-
Mean(88-9	-	-	-	46	-	-	-	-
+/- Mean	-	-	-	-81%	-	-	-	-

Late Bright Salmon

Year	Small Kept	Small Rel.	Small Total	Large	TOTAL	% Large	Rods	CPUE
1969	88	-	88	96	184	52.2	-	-
1970	39	-	39	25	64	39.1	-	-
1971	24	-	24	31	55	56.4	-	-
1972	49	-	49	232	281	82.6	-	-
1973	107	-	107	107	214	50.0	-	-
1974	28	-	28	45	73	61.6	-	-
1975	115	-	115	49	164	29.9	-	-
1976	78	-	78	29	107	27.1	-	-
1977	-	-	-	-	-	-	-	-
1978	101	-	101	42	143	29.4	-	-
1979	15	-	15	-	15	-	-	-
1980	115	-	115	69	184	37.5	-	-
1981	74	-	74	7	81	8.6	-	-
1982	117	-	117	63	180	35.0	-	-
1983	40	-	40	90	130	69.2	-	-
1984	110	-	-	55	-	-	-	-
1985	19	-	-	38	-	-	-	-
1986	69	-	-	60	-	-	-	-
1987	116	-	-	241	-	-	-	-
1988	70	-	-	281	-	-	-	-
1989	122	-	-	113	-	-	-	-
1990	40	-	-	56	-	-	-	-
1991	56	-	-	70	-	-	581	-
1992	191	67	258	425	683	62.2	939	0.727
1993	44	85	129	44	173	25.4	-	-
Mean(88-9	96	-	-	189	-	-	-	-
+/- Mean	-54%	-	-	-77%	-	-	-	-

Table 4. Bright Atlantic salmon catch and effort for Tabusintac Club (Crown Angling lease 13) 1981-1993.

	Early Bright Salmon							
	Small							
Year	Kept	Rel.	Total	Large	TOTAL	% Large	Rods	CPUE
1981	15	55	70	1	71	1.4	210	0.338
1982	2	16	18	15	33	45.5	300	0.110
1983	0	1	1	0	1	0.0	327	0.003
1984	0	0	0	2	2	100.0	200	0.010
1985	0	4	4	0	4	0.0	-	-
1986	1	6	7	7	14	50.0	240	0.058
1987	0	8	8	0	8	0.0	264	0.030
1988	1	17	18	0	18	0.0	256	0.070
1989	0	0	0	0	0	-	235	0.000
1990	0	3	3	0	3	0.0	275	0.011
1991	0	0	0	0	0	-	285	0.000
1992	0	10	10	0	10	0.0	270	0.037
1993	0	2	2	0	2	0.0	280	0.007
Mean(88-92)	0	6	6	0	6	-	264	0.023
+-Mean	-	-67%	-68%	-	-68%	-	6%	-70%

	Late Bright Salmon							
	Small							
Year	Kept	Rel.	Total	Large	TOTAL	% Large	Rods	CPUE
1981	9	45	54	29	83	34.9	235	0.353
1982	15	45	60	63	123	51.2	242	0.508
1983	0	5	5	7	12	58.3	275	0.044
1984	2	4	6	5	11	45.5	85	0.129
1985	3	3	6	3	9	33.3	-	-
1986	23	34	57	84	141	59.6	233	0.605
1987	36	44	80	103	183	56.3	256	0.715
1988	20	50	70	92	162	56.8	198	0.818
1989	13	31	44	35	79	44.3	170	0.465
1990	17	69	86	48	134	35.8	245	0.547
1991	14	52	66	92	158	58.2	270	0.585
1992	8	45	53	46	99	46.5	260	0.381
1993	8	67	75	76	151	50.3	240	0.629
Mean(88-92)	14	49	64	63	126	49.5	229	0.553
+-Mean	-44%	36%	18%	21%	19%	2%	5%	14%

	Total Bright Salmon								
	Small								% DNRE
Year	Kept	Rel.	Total	Large	TOTAL	% Large	Rods	CPUE	Catch
1981	24	100	124	30	154	19.5	445	0.346	86
1982	17	61	78	78	156	50.0	542	0.288	38
1983	0	6	6	7	13	53.8	602	0.022	6
1984	2	4	6	7	13	53.8	285	0.046	7
1985	3	7	10	3	13	23.1	0	-	23
1986	24	40	64	91	155	58.7	473	0.328	29
1987	36	52	88	103	191	53.9	520	0.367	51
1988	21	67	88	92	180	51.1	454	0.396	33
1989	13	31	44	35	79	44.3	405	0.195	23
1990	17	72	89	48	137	35.0	520	0.263	78
1991	14	52	66	92	158	58.2	555	0.285	66
1992	8	55	63	46	109	42.2	530	0.206	13
1993	8	69	77	76	153	49.7	520	0.294	77
Mean(88-92)	15	55	70	63	133	47.2	493	0.269	31
+-Mean	-45%	25%	10%	21%	15%	5%	6%	9%	148%

Table 5. Weekly catches of large and small salmon at Tabusintac River traps, 1993.

Week	Both traps Large	Both traps Small	Mark trap Large	Mark trap Small	Recapture trap Large	Recapture trap Small
35	0	2	0	2	0	0
36	0	6	0	0	0	6
37	0	3	0	1	0	2
38	1	3	1	1	0	2
39	80	72	68	58	12	14
40	53	47	37	40	16	7
41	35	20	26	11	9	9
42	9	3	6	3	3	0
43	2	0	2	0	0	0

Cumulative total

Week	Both traps Large	Both traps Small	Mark trap Large	Mark trap Small	Recapture trap Large	Recapture trap Small
35	0	2	0	2	0	0
36	0	8	0	2	0	6
37	0	11	0	3	0	8
38	1	14	1	4	0	10
39	81	86	69	62	12	24
40	134	133	106	102	28	31
41	169	153	132	113	37	40
42	178	156	138	116	40	40
43	180	156	140	116	40	40

Table 6. Standardized weeks used to describe timing.

Week	Month	Days
34	August	20-26
35	August	27-02
36	September	03-09
37	September	10-16
38	September	17-23
39	September	24-30
40	October	01-07
41	October	08-14
42	October	15-21
43	October	22-28

Table 7. Age distribution of Tabusintac R. salmon, 1992.
SW = sea winter. Repeat spawner categories indicate total sea age, followed by sea ages at which the fish spawned.

			Repeat Spawners		
Smolt Age	1SW	2SW	5.2.4	6.2.4	Total
2	4	4	1	0	9
3	1	7	0	1	9
?	0	1	0	0	1
Total	5	12	1	1	19

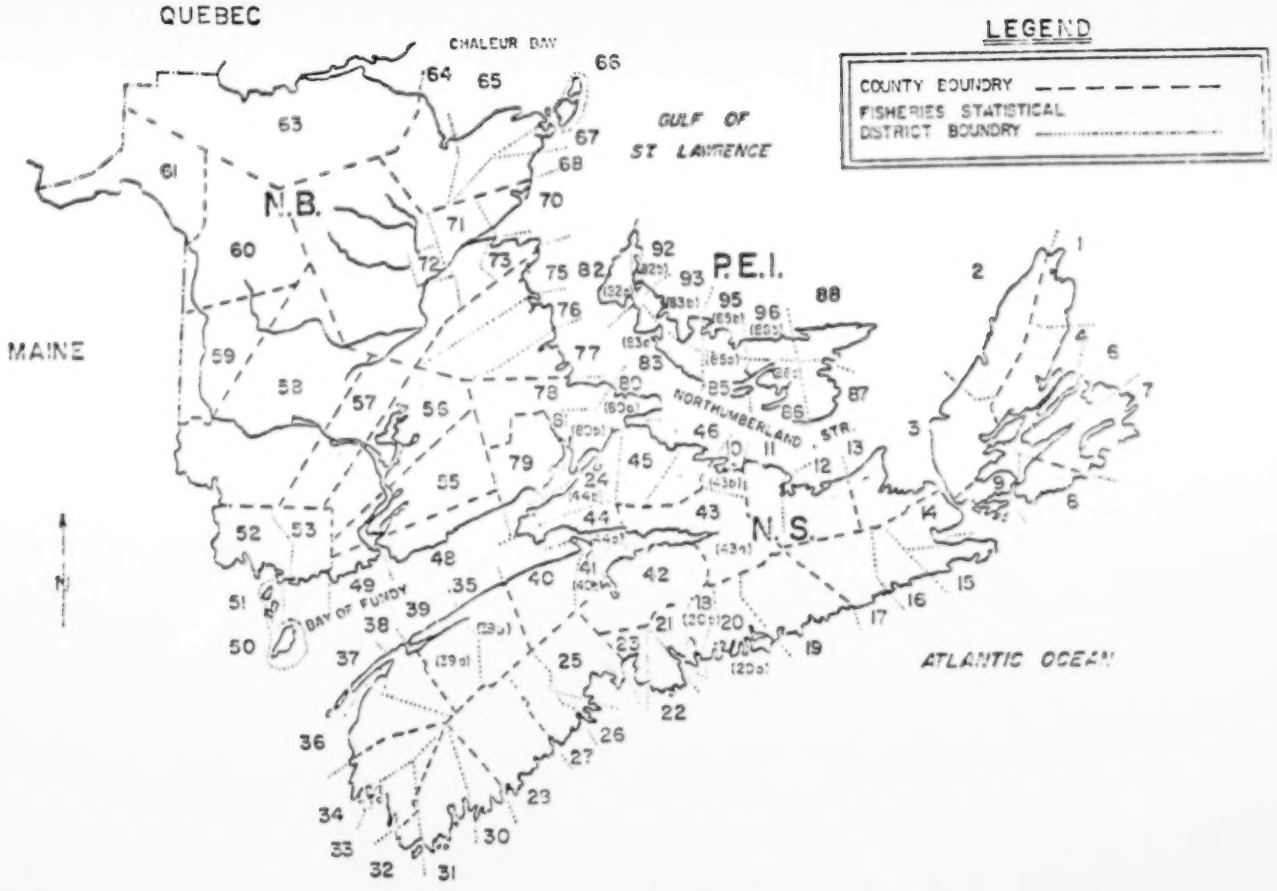


Figure 1. Fisheries Statistical Districts in Atlantic Canada.

Figure 2. Atlantic salmon angling rivers of New Brunswick. (Map prepared by DNRE.)

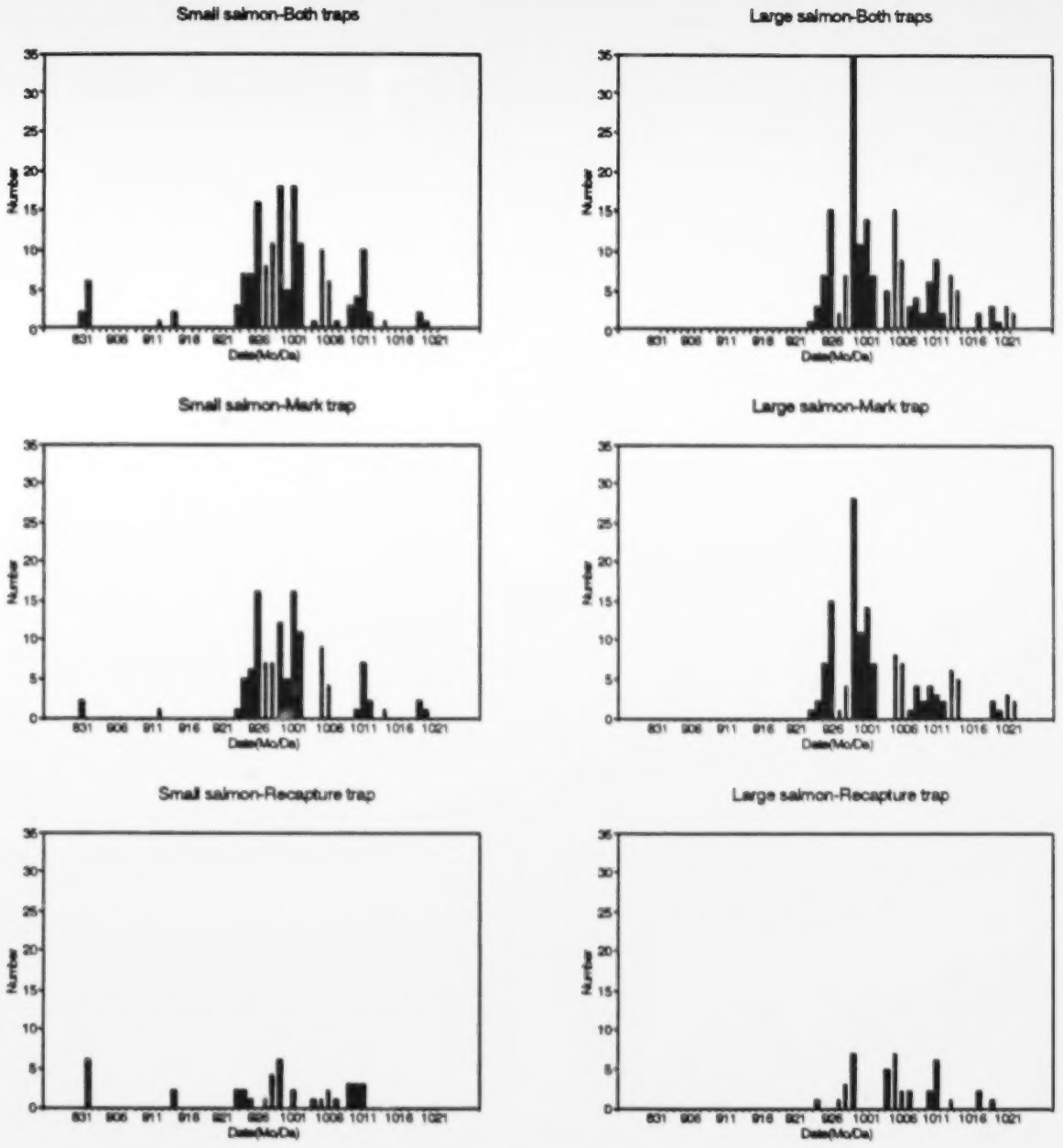
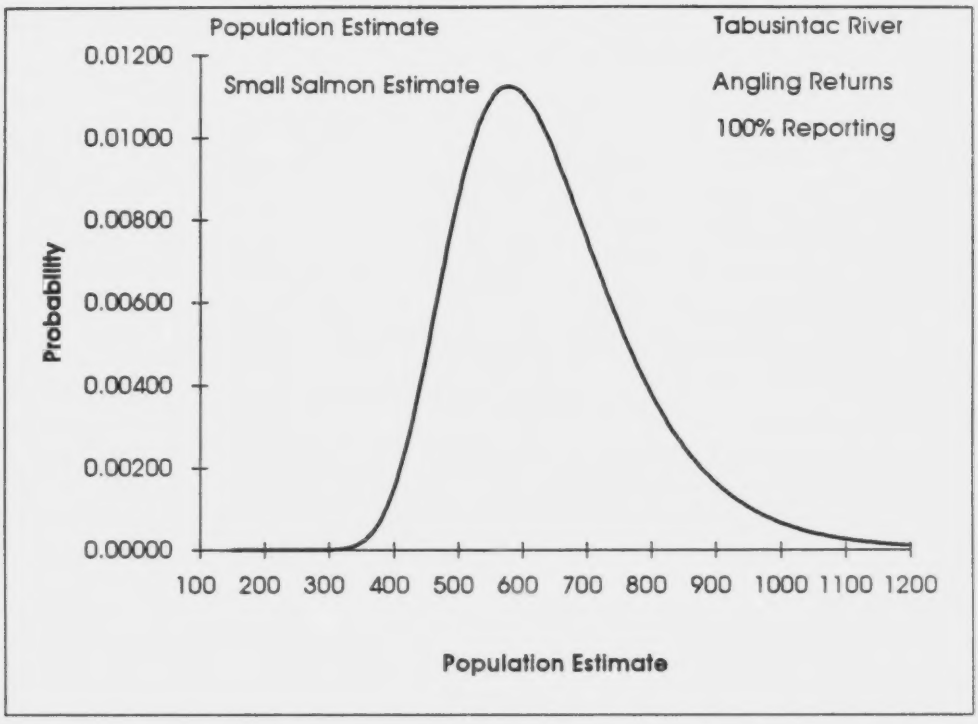


Figure 3. Daily catches of small and large salmon at Tabusintac River traps,1993. Mark trap operated from 806-1028; recapture trap from 731- 1028.



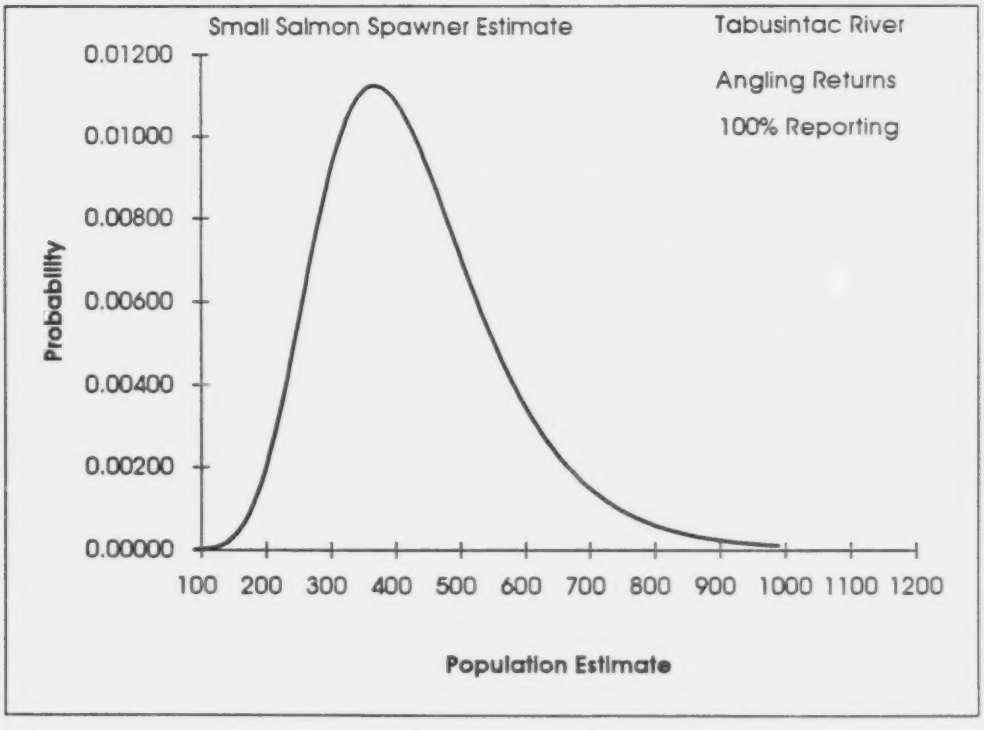
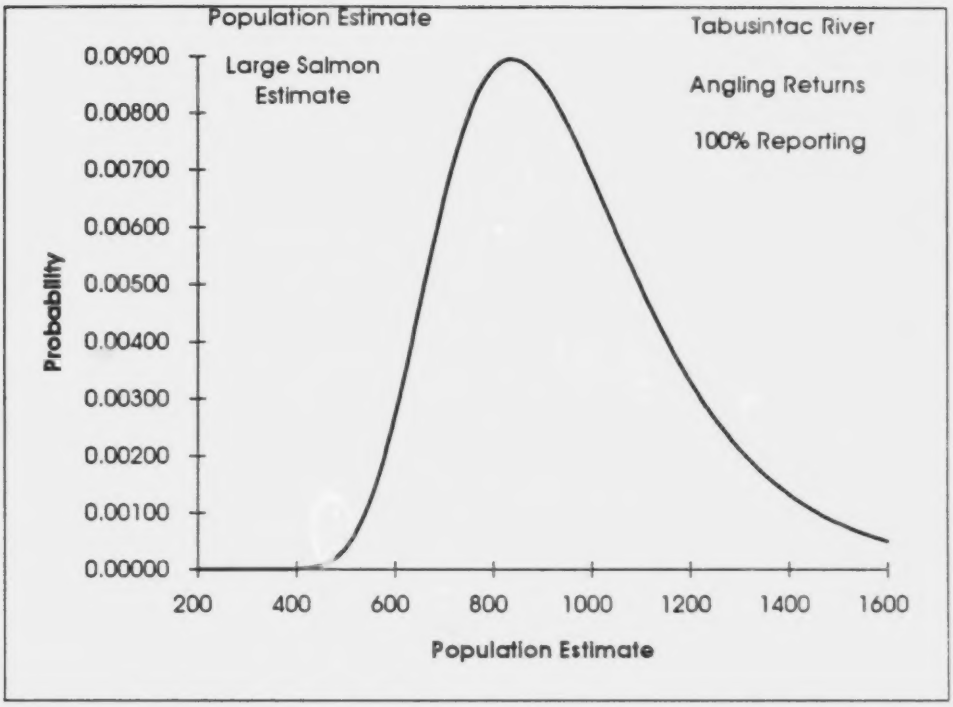


Fig. 4. Distribution of estimates of total returns and spawning escapement for small salmon in the Tabusintac River, 1993.



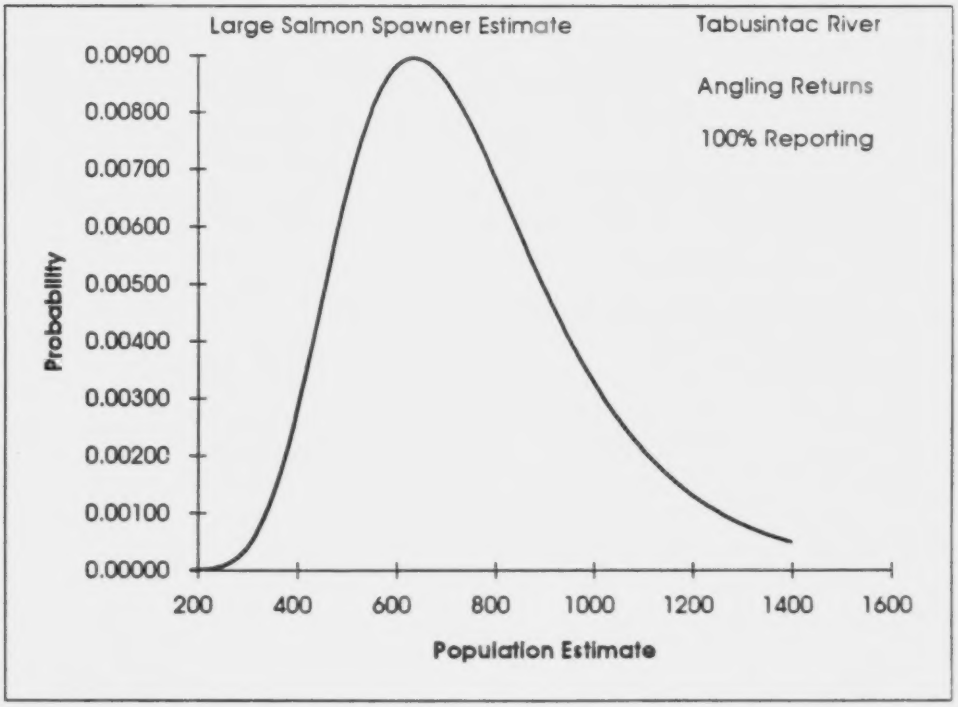


Fig. 5. Distribution of estimates of total returns and spawning escapement for large salmon in the Tabusintac River, 1993.

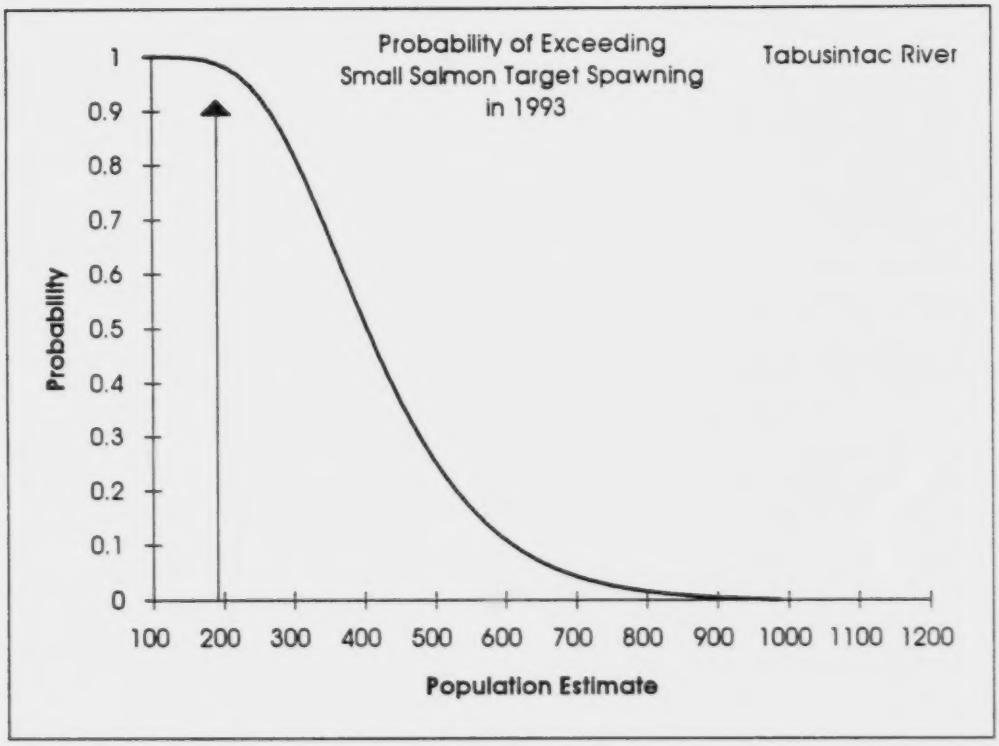


Fig. 6. Probability of exceeding small salmon target spawning escapment of 200 in 1993 for the Tabusintac River.

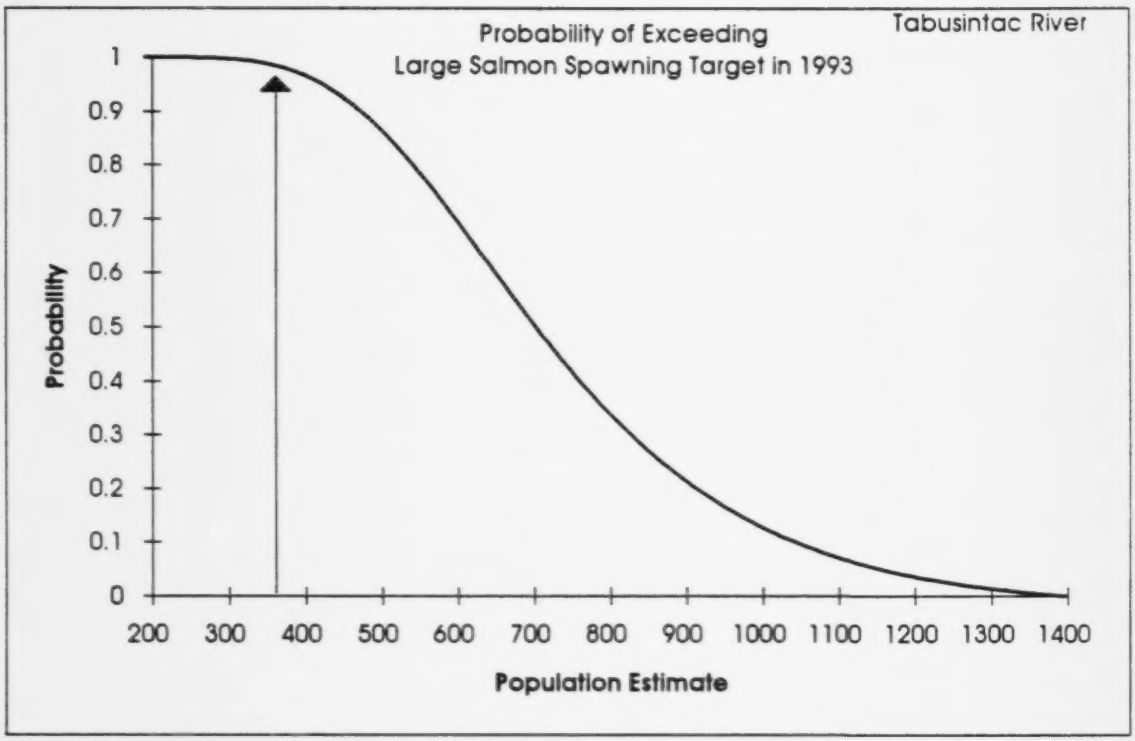
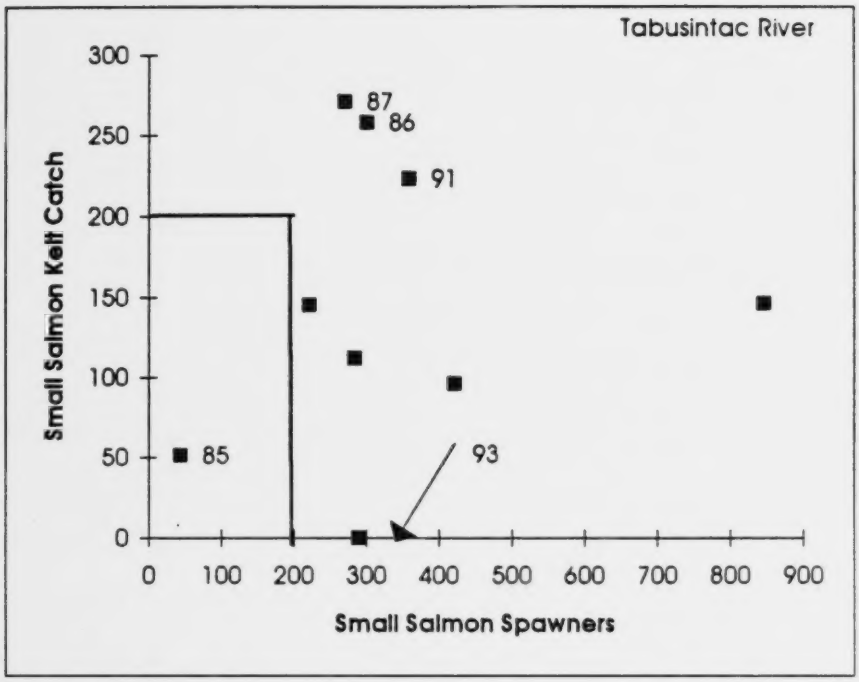


Fig. 7. Probability of exceeding large salmon target spawning escapement of of 372 in 1993 for the Tabusintac River.



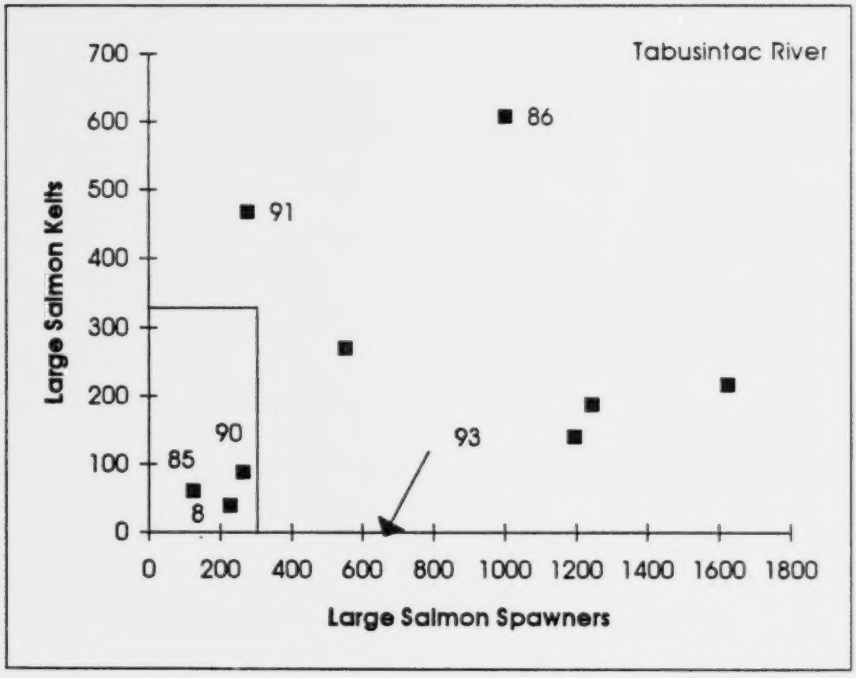


Fig. 8. Years when spawning escapment for small and large salmon were exceded based on kelt and bright angling catch. The values for 1993 are mark-recapture estimates. The years shown are spawning years.

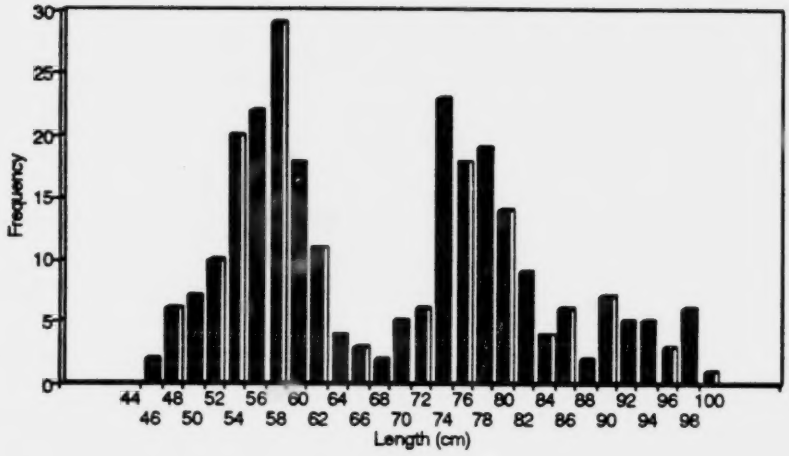


Figure 9. Length frequency of salmon caught in Tabusintac R. traps, 1993.

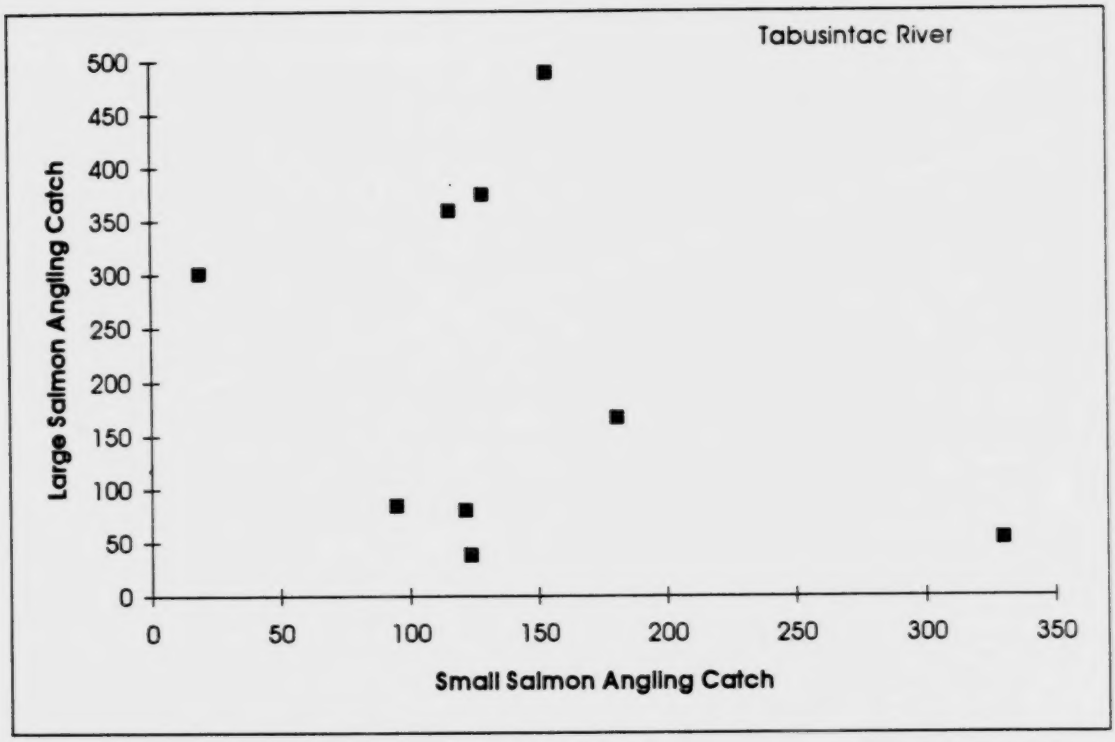


Fig. 10. Scatterplot of small salmon angling catch and large salmon angling catch the following year for the Tabusintac River.